Claims

1. A method of producing curved cuts (9) in a transparent material, in particular in the cornea (5) of the eye, by generating optical breakthroughs (8) at different locations in the material (5) by means of pulsed laser radiation (3) focused into the material (5), wherein said laser radiation (3) is two-dimensionally deflected so as to produce the cut (9) by sequential arrangement of the optical breakthroughs (8), **characterized in that** the two-dimensional deflection is effected such that the locations of optical breakthroughs (8) are spaced apart, along a curve at which the optical breakthroughs (8) are sequentially arranged, according to a deflection-related angular function which is non-linear and adapted to the curvature of the cut (9) such that the locations of optical breakthroughs (8) adjacent along the curve are spaced by the same distance (D) within a certain tolerance.

2. The method as claimed in Claim 1, characterized in that the tolerance is 20%.

3. The method as claimed in any one of the above Claims, characterized in that the laser radiation (3) is uniformly pulsed and the deflection in both dimensions (x, y) is effected in a non-linear manner.

4. The method as claimed in Claim 3, characterized in that the deflection is effected about two mutually perpendicular axes (x, y), with the laser radiation (3) being guided along a meander-shaped pattern.

5. The method as claimed in any one of the above Claims, characterized in that, at the periphery of a region (13), in which the cut (9) is produced, deflection in a dimension (x) is effected at a lower speed than at the center (14) of the region (13).

6. The method as claimed in any one of the above Claims 3 to 5, characterized in that the cut (9) is spherically curved with a radius R, the laser radiation (3) is incident in the material (5) along a main axis of incidence (H) and is biaxially deflected along an x-axis and a y-axis in a plane perpendicular to said main axis of incidence (H), wherein a step width dx between locations on the curve of adjacent optical breakthroughs (8) is set in the plane in x-direction according to:

$$dx = D \bullet \frac{R1}{\sqrt{R1^2 - x^2}},$$

wherein D designates the distance of the optical breakthroughs (8) and

$$R1 = R \bullet \cos(\arctan \frac{y}{R}).$$

7. The method as claimed in any one of the above Claims, characterized in that, at the periphery of a region (13) in which the cut (9) is produced, the pulse rate of the laser radiation (3) is different from, in particular higher than, the rate at the center (14) of the cut.

8. The method as claimed in any one of the above Claims, characterized in that the two-dimensional deflection is effected according to two deflection functions (16, 17) associated with the two-dimensional deflection, wherein one of said two deflection functions (16) is parametrized with the coordinate to which the other of said two deflection functions (17) is assigned.

9. Apparatus for producing curved cuts (9) in a transparent material, in particular in the cornea (5) of the eye, said apparatus comprising a pulsed laser radiation source (S) which focuses laser radiation (3) into the material (5) and causes optical breakthroughs (8) there, wherein a deflecting unit (10) deflecting the laser radiation (3) two-dimensionally and a control unit (2) controlling said deflecting unit (10) are provided so as to form the cut (9) by sequential arrangement of the optical breakthroughs (8) in the material (5) **characterized in that** the control unit (2) controls the deflecting unit (10) two-dimensionally according to a deflection function (16, 17) such that the locations of optical breakthroughs (8) along a curve on which the optical breakthroughs (8) are sequentially arranged are spaced apart according to a deflection-related angular function, which is non-linear and adapted to the curvature of the cut (9), such that the locations of optical breakthroughs (8) adjacent along the curve are spaced by the same distance (D) within a certain tolerance.

10. The apparatus as claimed in Claim 9, characterized in that the tolerance is 20%.

11. The apparatus as claimed in any one of the above apparatus claims, characterized in that the laser radiation source (S) emits uniformly pulsed laser radiation (3), and the control unit (2) controls the deflecting unit (10) in both dimensions (x, y) according to a non-linear deflection function (16, 17).

12. The apparatus as claimed in any one of the above apparatus claims, characterized in that the deflection is effected about two mutually perpendicular axes (x, y), wherein the control unit (2) guides the laser radiation (3) along a meander-shaped pattern.

13. The apparatus as claimed in any one of the above apparatus claims, characterized in that, at the periphery of a region (13) in which the cut (9) is produced, deflection in one dimension (x) is effected at a lower speed than at the center (14) of the region (13).

14. The apparatus as claimed in any one of the above apparatus claims, characterized in that the cut (9) is spherically curved with a radius R, the laser radiation (3) is incident in the material (5) along a main axis of incidence (H) and the deflecting unit (10) biaxially deflects the laser radiation (3) along an x-axis and a y-axis in a plane perpendicular to said main axis of incidence (H), wherein the control unit (2) sets a step width dx between locations on the curve of adjacent optical breakthroughs (8) in the plane in x-direction according to:

$$dx = D \bullet \frac{R1}{\sqrt{R1^2 - x^2}},$$

wherein D designates the distance of the optical breakthroughs (8) and

$$R1 = R \bullet \cos(\arctan\frac{y}{R}).$$

15. The apparatus as claimed in any one of the above apparatus claims, characterized in that, at the periphery of a region (13) in which the cut (9) is produced, the control unit (2) controls the pulse rate of the laser radiation (3) differently from, in particular higher than, the rate at the center (14) of the cut.

16. The apparatus as claimed in any one of the above apparatus claims, characterized in that the two-dimensional deflection is effected according to two deflection functions (16, 17) assigned to the two-dimensional deflection, wherein one of said two deflection functions (16) is parametrized with the coordinate to which the other of said two deflection functions (17) is assigned.